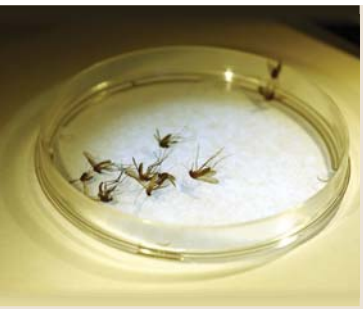
JANUARY 2015

Volume 22
Number 1

MSMR

MEDICAL SURVEILLANCE MONTHLY REPORT



CDC/Melissa Brower

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
JAN 2015		**00-00-2015 to 00-00-2015**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Medical Surveillance Monthly Report	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Medical Surveillance Monthly Report (MSMR),,Armed Forces Health Surveillance Center,,11800 Tech Road, Suite 220 (MCAF-CS),,Silver Spring,,MD,20904**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
MSMR, Volume 22, Number 1, January 2015

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**21**	

Update: Malaria, U.S. Armed Forces, 2014

U.S. service members are at risk of acquiring malaria infection when they are present in endemic areas because of long-term duty assignments, participation in shorter-term contingency operations, or personal travel. The number of malaria cases in 2014 (n=44) was slightly higher than in 2012 and 2013, but remained relatively low compared to 2005–2011. In 2014, more than one-third of cases were linked to Africa (n=15); 10 cases to Korea; and eight to Afghanistan. More than half (52%) of the 2014 cases were caused by *Plasmodium falciparum* (n=23) and 16% by *P. vivax* (n=7); one-third were reported as "unspecified" malaria. Malaria was reported from 30 different medical facilities in the U.S., Afghanistan, Germany, Italy, Japan, Korea, Kuwait, and the U.K. The relatively low numbers of cases during 2012–2014 likely reflect a decrease in the number of troops who served in Afghanistan in those years. Providers of health care to military members should be knowledgeable regarding, and vigilant for, clinical presentations of malaria outside of endemic areas.

Malaria is endemic in approximately 100 countries throughout tropical and subtropical regions of the world. In 2013, malaria accounted for an estimated 198 million illnesses and 584,000 deaths worldwide; these estimates from the World Health Organization are slightly lower than those for 2012.[1] International efforts to control malaria are working; many countries have reported reductions in the numbers of malaria cases and deaths during the past decade. Most malaria deaths still are due to *Plasmodium falciparum* infections of young children in sub-Saharan Africa.[1]

Since 1999, the *MSMR* has published annual updates on the incidence of malaria among U.S. service members.[2,3] The *MSMR* focus on malaria reflects both historical lessons learned about this mosquito-borne disease and the continuing threat it poses to military operations and service members' health. Malaria not only afflicted many thousands of service members during World War II (approximately 695,000 cases), the Korean War (approximately 390,000 cases), and the conflict in Vietnam (approximately 50,000 cases),[4–5] but it has also necessitated heightened vigilance, preventive measures, and treatment of cases associated with more recent military engagements in Africa, Asia, the Caribbean, and Southwest Asia and the Middle East.[6–13] In the planning for overseas military operations, the geography-based presence or absence of the malaria threat is usually known and can be anticipated. However, when preventive countermeasures are needed, their effective implementation is multifaceted and depends on the provision of protective equipment and supplies, individuals' understanding of the threat and their attention to personal protective measures, treatment of malaria cases, and medical surveillance. The U.S. Armed Forces have long had policies and prescribed countermeasures effective against vector-borne diseases such as malaria, including chemoprophylactic drugs, permethrin-impregnated uniforms and bed nets, and topical insect repellents containing N,N-diethyl-*meta*-toluamide (DEET). When cases and outbreaks of malaria do occur, they are usually due to noncompliance with indicated chemoprophylactic or personal protective measures.[7–9]

The past two *MSMR* updates on malaria documented that the numbers of cases in active component service members in 2012 and 2013 were the lowest annual counts in 15 years.[3,14] In particular, the numbers of cases associated with service in Afghanistan had fallen sharply in the past 2 years, presumably due to the dramatic reduction in the numbers of service members serving there. This update for 2014 replicates the previously used methods in describing the epidemiologic patterns of malaria incidence in the active component of the U.S. Armed Forces.

METHODS

The surveillance period was 1 January 2005 through 31 December 2014. The surveillance population included active and reserve component members of the U.S. Armed Forces. The Defense Medical Surveillance System (DMSS) was searched to identify reportable medical events and hospitalizations (in military and nonmilitary facilities) that included diagnoses of malaria (ICD-9-CM code: 084). A case of malaria was defined as an individual with 1) a reportable medical event record of confirmed malaria; 2) a hospitalization record with a primary (first-listed) diagnosis of malaria (ICD-9-CM codes: 084.0–084.6, 084.8–084.9); 3) a hospitalization record with a non-primary diagnosis of malaria due to a specific *Plasmodium* species (ICD-9-CM codes: 084.0–084.3); 4) a hospitalization record with a nonprimary diagnosis of malaria plus a diagnosis of anemia (ICD-9-CM codes: 280–285), thrombocytopenia and related conditions (ICD-9-CM code: 287), or malaria complicating pregnancy (ICD-9-CM code: 647.4) in any diagnostic position; or 5) a hospitalization record with a nonprimary diagnosis of malaria plus diagnoses of signs or

symptoms consistent with malaria (as listed in the Control of Communicable Diseases Manual, 18th Edition)[15] in each diagnostic position antecedent to malaria. Malaria diagnoses during outpatient encounters alone (i.e., not hospitalized or reported as a notifiable event) were not considered case-defining for this analysis.

This summary allowed one episode of malaria per service member per 365-day period. When multiple records documented a single episode, the date of the earliest encounter was considered the date of clinical onset, and the most specific diagnosis was used to classify the *Plasmodium* species.

Presumed locations of malaria acquisition were estimated using a hierarchical classification algorithm: 1) cases hospitalized in a malarious country were considered acquired in that country; 2) case reports (submitted as reportable medical events) that listed exposures to malaria endemic locations were considered acquired in those locations; 3) cases diagnosed among service members during or within 30 days of deployment or assignment to a malarious country were considered acquired in that country; 4) cases diagnosed among service members who had been deployed to Afghanistan or Korea within 2 years prior to diagnosis were considered acquired in those countries; and 5) all remaining cases were considered acquired in unknown locations.

RESULTS

In 2014, the number of U.S. service members (n=44) diagnosed and/or reported with malaria was slightly higher than the numbers in 2012 (n=40) and 2013 (n=38), but the number was relatively low compared to prior years (range for 2005–2011: 67–145 cases per year) **(Figure 1)**. Although the overall annual counts of malaria were similar during 2012–2014, the proportion of cases caused by *P. vivax* decreased while the proportion due to *P. falciparum* increased. More than half (52%) of the 2014 cases were caused by *P. falciparum* (n=23), in contrast to 29% and 15% in 2013 and 2012, respectively. About 16% of cases were attributed to *P. vivax* (n=7) in 2014, but the *P. vivax* percentages in 2013 and 2012 were 32% and 48% **(Figure 1, Table 1).** The responsible agent was "unspecified" for more than one-quarter (n=12) of 2014 cases.

In 2014, as in prior years, most U.S. military members diagnosed with malaria were male (95.5%), active component members (86.4%), in the Army (68.2%), and in their 20s (59.1%) **(Table 1)**. The number (n=23) and the proportion (52.3%) of all cases that affected black, non-Hispanic service members in 2014 were higher than any year of the period 2006–2013, during

FIGURE 1. Malaria cases among U.S. service members, by *Plasmodium* species and calendar year of diagnosis/report, 2005–2014

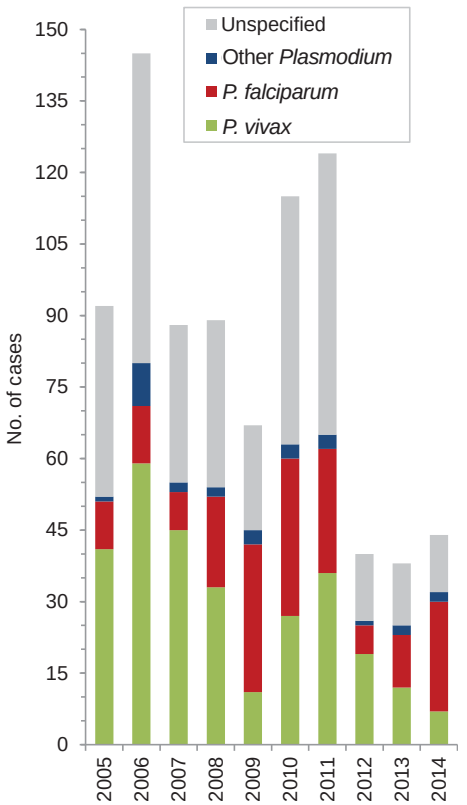


TABLE 1. Malaria cases by *Plasmodium* species and selected demographic characteristics, U.S. Armed Forces, 2014

	P. vivax	*P. falciparum*	Unspecified/other	Total	% total
Total	7	23	14	44	100.0
Component					
Active	7	20	11	38	86.4
Reserve/Guard	0	3	3	6	13.6
Service					
Army	6	13	11	30	68.2
Navy	0	4	0	4	9.1
Air Force	0	1	2	3	6.8
Marine Corps	1	5	1	7	15.9
Coast Guard	0	0	0	0	0.0
Gender					
Male	7	22	13	42	95.5
Female	0	1	1	2	4.5
Age group					
20–24	5	6	5	16	36.4
25–29	1	5	4	10	22.7
30–34	1	6	3	10	22.7
35–39	0	3	1	4	9.1
40–44	0	1	1	2	4.5
45–49	0	2	0	2	4.5
Race/ethnicity					
White, non-Hispanic	4	6	5	15	34.1
Black, non-Hispanic	1	15	7	23	52.3
Other	2	2	2	6	13.6

TABLE 2. Locations of malaria diagnoses or reports and presumed locations of malaria acquisition, U.S. Armed Forces, 2014

	Presumed location of infection acquisition						
Location of diagnosis/report	Africa	Korea	Afghanistan	South/ Central America	Other location	Location total	% of total 2014 cases
Fort Stewart, GA	.	2	.	.	1	3	6.8
Vincenza Army Health Clinic, Italy	2	.	1	.	.	3	6.8
Brian Allgood Army Community Hospital, Seoul, Korea	.	3	.	.	.	3	6.8
Camp Casey, Korea	.	3	.	.	.	3	6.8
Location not reported	.	.	2	.	1	3	6.8
Walter Reed National Military Medical Center, MD	.	.	.	.	2	2	4.5
Camp Lejeune, NC	2	.	.	.	.	2	4.5
Naval Medical Center Portsmouth, VA	2	.	.	.	.	2	4.5
Landstuhl Regional Medical Center, Germany	1	.	.	.	1	2	4.5
Camp Pendelton, CA	.	.	1	.	.	1	2.3
Fort Carson, CO	.	.	.	.	1	1	2.3
Fort Gordon, GA	.	.	.	.	1	1	2.3
Fort Benning, GA	1	.	.	.	.	1	2.3
Fort Polk, LA	.	1	.	.	.	1	2.3
Fort Bragg, NC	.	.	1	.	.	1	2.3
Fort Bliss, TX	.	1	.	.	.	1	2.3
Fort Hood, TX	.	.	1	.	.	1	2.3
Joint base Langley-Eustis, VA	1	.	.	.	.	1	2.3
Fort Lewis, WA	.	.	.	.	1	1	2.3
Naval Hospital Bremerton, WA	1	.	.	.	.	1	2.3
Naval Station San Diego, CA	1	.	.	.	.	1	2.3
Naval Air Station Norfolk, VA	.	.	.	.	1	1	2.3
Naval Hospital Naples, Italy	1	.	.	.	.	1	2.3
Lakenheath Medical Center, United Kingdom	1	.	.	.	.	1	2.3
Vilseck Army Health Clinic, Germany	.	.	1	.	.	1	2.3
Fort Drum, NY	.	.	.	.	1	1	2.3
Camp Hansen, Okinawa, Japan	1	.	.	.	.	1	2.3
Fort Riley, KS	.	.	.	.	1	1	2.3
Camp Arifjan, Kuwait	1	.	.	.	.	1	2.3
Bagram/Camp Lacy, Afghanistan	.	.	1	.	.	1	2.3
Total (% total)	15 (34.1%)	10 (22.7%)	8 (18.2%)	0	11 (25.0%)	44	100.0

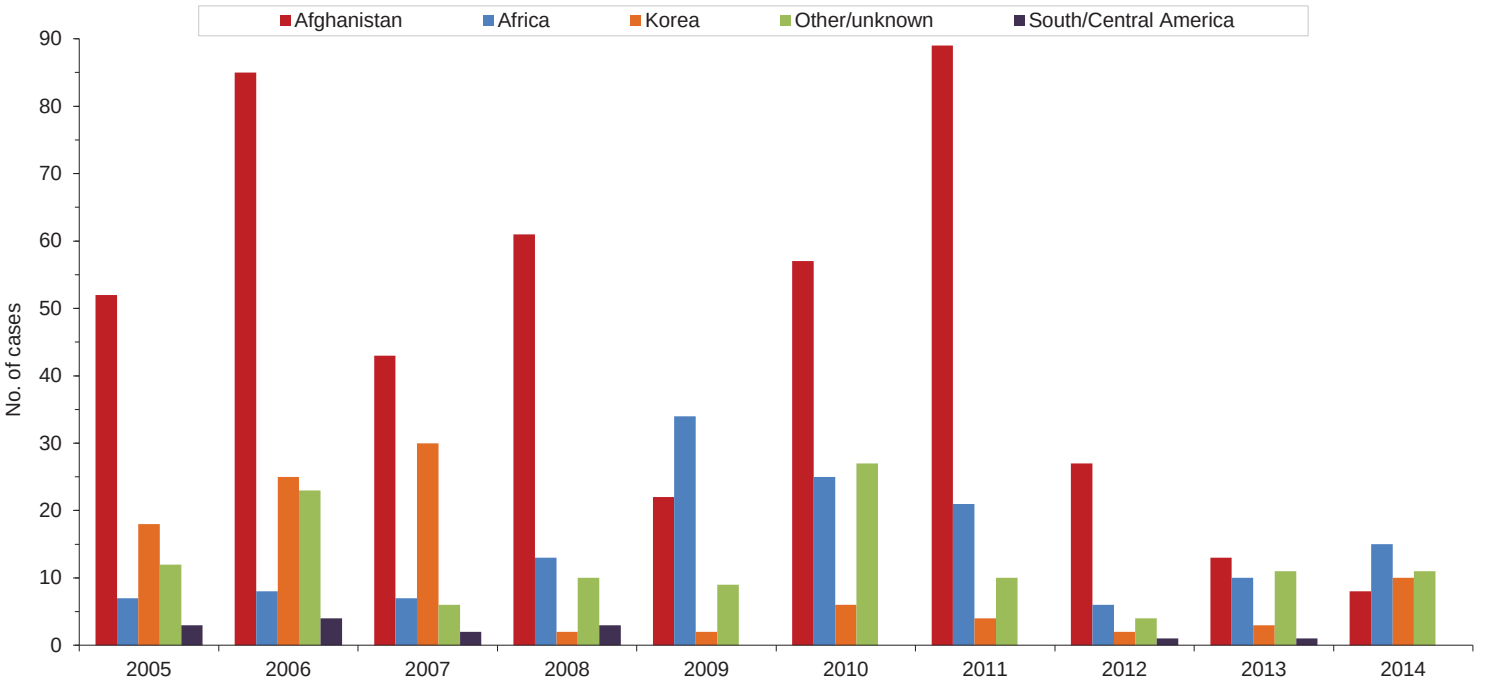
which the mean number of annual cases was 11.5 and the overall percentage of cases among black, non-Hispanics was 15.0% **(data not shown)**.

Of the 44 malaria cases in 2014, more than one-third of the infections were considered to have been acquired in Africa (n=15; 34.1%), 22.7% in Korea (n=10), and 18.2% in Afghanistan (n=8) **(Table 2)**. During 2005–2013, malaria attributed to Afghanistan accounted for 56% of all cases **(data not shown)**. There were no cases identified from South/Central America in 2014; for the remaining 11 malaria cases, no specific geographic location could be discerned from the available documentation. Of the 15 malaria infections considered acquired in Africa, three infections were linked to Ghana, two each were linked to Nigeria and Sudan, and one each to Cameroon, Guinea, Malawi, Sierra Leone, Somalia, Tanzania, and Uganda; for one case, a specific African country was not identified **(data not shown)**.

During 2014, malaria cases were diagnosed in or reported from 30 different medical facilities in the U.S., Afghanistan, Germany, Korea, Japan, Italy, U.K., and Kuwait. More than one-third of cases (n=17, 39%) were reported from or diagnosed outside the U.S. **(Table 2)**. The largest number of malaria cases associated with a single medical facility during the year was three each at Fort Stewart, GA, Vicenza Army Health Clinic, Italy, Camp Casey, Korea, and Brian Allgood Army Community Hospital, Korea.

The number of Africa-acquired cases (n=15) was higher than the corresponding annual numbers of cases in 2013 (n=10) and 2012 (n=6), but lower than the numbers in the years 2009–2011 (range: 21–34 cases) **(Figure 2)**. The number of Afghanistan-acquired malaria cases in 2014 (n=8) was the lowest of the 10-year surveillance period. The number of malaria cases

FIGURE 2. Numbers of malaria cases by location of acquisition, active component, U.S. Armed Forces, 2005–2014



acquired in Korea in 2014 (n=10) was higher than the numbers in recent prior years (range, 2008–2013: 2–6 cases), but lower than numbers in the first 3 years of the surveillance period (range, 2005–2007: 18–30 cases).

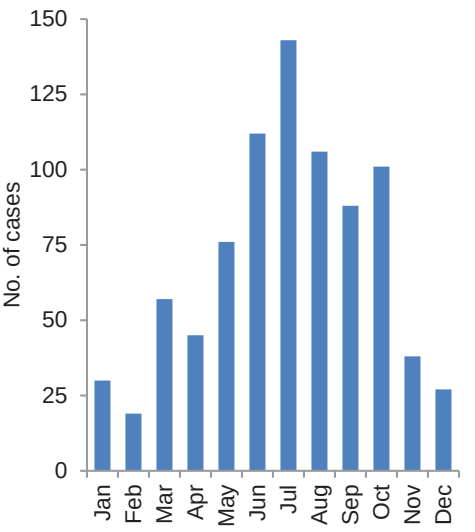
In 2014, 77% of malaria cases among U.S. service members were diagnosed during May–October. This proportion is similar to the 74% of cases diagnosed during the same 6-month period over the entire 10-year period **(Figure 3)**. During the past 10 years, the proportions of malaria cases diagnosed or reported during May–October varied by region of acquisition: Korea (98%); Afghanistan (81%); Africa (55%); and South/Central America (50%) **(data not shown)**.

EDITORIAL COMMENT

In 2014, there were a few more cases of malaria diagnosed/reported among U.S. military members than in 2012 and 2013, but the numbers of cases in the most recent 3 years indicate a marked decline in malaria incidence compared to the previous 7 years. Most of that decline is attributable to the decrease in numbers of malaria cases associated with service in Afghanistan. The dominant factor in that trend has undoubtedly been the progressive withdrawal of U.S. forces from that country. This report also documents the fluctuating incidence of acquisition of malaria in Africa and Korea among U.S. military members during the past decade. Although the predominant species of malaria in Korea and Afghanistan has been *P. vivax*, the more dangerous *P. falciparum* species is of primary concern in Africa. The planning and execution of military operations on that continent must incorporate actions to counter the threat of infection by that potentially deadly parasite wherever it is endemic. The recent employment of U.S. service members to aid in the response to the ongoing Ebola virus outbreak in West Africa is an example of an operation where the risk of *P. falciparum* malaria is significant. Individual service members must be diligent in protecting themselves from biting mosquitoes and in taking prescribed chemoprophylactic drugs.

The finding that *P. falciparum* malaria was diagnosed in more than half of the cases in 2014 emphasizes the need for continued emphasis on prevention of this disease, given its potential severity and risk of death. Although the case count for *P. falciparum* may be largely explained by infections acquired in Africa, the absence of data about geographic location of

FIGURE 3. Cumulative numbers of diagnoses and reported cases of malaria, by month of clinical presentation/diagnosis, U.S. Armed Forces, January 2005–December 2014



acquisition for 11 cases precludes a firm conclusion about that possibility. The striking decline in cases associated with service in Afghanistan, where *P. vivax* predominates, allowed *P. falciparum* to account for the highest proportion of cases in 2014. The seven cases of *P. vivax* in 2014 represented the lowest annual count of that species in the past decade.

The observations about the seasonality of diagnoses of malaria are compatible with the presumption that the risk of acquiring and developing symptoms of malaria in a temperate climatic zone of the northern hemisphere would be greatest during May–October. Given the typical incubation periods of malaria infection (approximately 9–14 days for *P. falciparum*, 12–18 days for *P. vivax* and *P. ovale*, and 18–40 days for *P. malariae*)[15] and the seasonal disappearance of biting mosquitoes during the winter, most malaria acquired in Korea and Afghanistan would be expected to cause symptoms during the warmer months of the year. It should be noted, however, that studies of *P. vivax* malaria in Korea have found that the incubation period can be remarkably long, ranging from 1–18 months.[16] On the other hand, transmission of malaria in tropical regions such as sub-Saharan Africa is less subject to the limitations of the seasons in temperate climates but depends more on other factors affecting mosquito breeding such as the timing of the rainy season and altitude (below 2000 meters).[17]

There are significant limitations to this report that should be considered when interpreting the findings. For example, the ascertainment of malaria cases is likely incomplete; some cases treated in deployed or non-U.S. military medical facilities may not have been reported or otherwise ascertained at the time of this analysis. A review of the series of *MSMR* updates on malaria reveals that the annual counts of cases for the most recent year have often been revised upward when the data analyses are repeated for subsequent updates. For example, this update reports 38 cases for 2013, but the original count in last year's update reported 30 cases. Similarly, the original count of 38 cases for 2012 was revised upward to 40 cases the following year. Additionally, only malaria infections that resulted in hospitalizations in fixed facilities or were reported as notifiable medical events were considered cases for this report. Infections that were treated only in outpatient settings and not reported as notifiable events were not included as cases. Also, the locations of infection acquisitions were estimated from reported relevant information. Some cases had reported exposures in multiple malarious areas, and others had no relevant exposure information. Personal travel to, or military activities in, malaria-endemic countries were not accounted for unless specified in notifiable event reports.

As in prior years, in 2014 most malaria cases among U.S. military members were treated at medical facilities remote from malaria endemic areas. Providers of acute medical care to service members (in both garrison and deployed settings) should be knowledgeable of, and vigilant for, the early clinical manifestations of malaria among service members who are or were recently in malaria-endemic areas. Care providers should also be capable of diagnosing malaria (or have access to a clinical laboratory that is proficient in malaria diagnosis) and initiating treatment (particularly when *P. falciparum* malaria is clinically suspected).

Continued emphasis on standard malaria prevention protocols is warranted for all military members at risk of malaria. Personal protective measures against malaria include the proper wear of uniforms and the use of bed nets, both of which have been permethrin-impregnated; the topical use of military issued DEET-containing insect repellent; and compliance with prescribed chemoprophylactic drugs before, during, and after times of exposure in malarious areas.

REFERENCES

1. World Health Organization. Factsheet on the World Malaria Report 2014. December 2014. http://www.who.int/malaria/media/world_malaria_report_2014/en/. Accessed on 20 January 2015.
2. U.S. Army Center for Health Promotion and Preventive Medicine. Malaria, U.S. Army, 1998. *MSMR*. 1999;5(1):2–3, 8.
3. Armed Forces Health Surveillance Center. Update: Malaria, U.S. Armed Forces, 2013. *MSMR*. 2014;21(1):4–7.
4. Gupta RK, Gambel JM, Schiefer BA. Personal Protection Measures Against Arthropods. In: Chapter 22, Military Preventive Medicine: Mobilization and Deployment, Volume 1. Kelley, PW (ed.). Department of the Army, Office of the Surgeon General. Textbooks of Military Medicine. 2003:503–521.
5. Ognibene AJ, Barrett, O. Malaria: Introduction and Background. In: Internal Medicine in Vietnam (Vol II): General Medicine and Infectious Diseases. Ognibene AJ, Barrett O (eds.). Office of the Surgeon General, Center of Military History, U.S. Army, Washington, DC, 1982:271–278.
6. Shanks GD, Karwacki JJ. Malaria as a military factor in Southeast Asia. *Mil Med.*1991; 156(12):684–668.
7. Kotwal RS, Wenzel RB, Sterling RA, et al. An outbreak of malaria in US Army Rangers returning from Afghanistan. *JAMA*. 2005;293(2):212–216.
8. Whitman TJ, Coyne PE, Magill AJ, et al. An outbreak of *Plasmodium falciparum* malaria in U.S. Marines deployed to Liberia. *Am J Trop Med Hyg.* 2010;83(2):258–265.
9. Centers for Disease Control and Prevention. Malaria acquired in Haiti–2013. *MMWR*. 2010;59(8): 217–218.
10. Lee JS, Lee WJ, Cho SH, Ree H. Outbreak of vivax malaria in areas adjacent to the demilitarized zone, South Korea, 1998. *Am J Trop Med Hyg.* 2002;66(1):13–17.
11. Armed Forces Health Surveillance Center (Provisional). Korea-acquired malaria, U.S. Armed Forces, January 1998–October 2007. *MSMR*. 2007;14(8):2–5.
12. Ciminera P, Brundage J. Malaria in U.S. military forces: a description of deployment exposures from 2003 through 2005. *Am J Trop Med Hyg.* 2007;76(2): 275–279.
13. Armed Forces Health Surveillance Center. Malaria among deployers to Haiti, U.S. Armed Forces, 13 January–30 June 2010. *MSMR*. 2010;17(8):11.
14. Armed Forces Health Surveillance Center. Update: Malaria, U.S. Armed Forces, 2012. *MSMR*. 2013;20(1):2–5.
15. Heymann DL, ed. Control of Communicable Diseases Manual, 18th Edition. Washington: American Public Health Association; 2004.
16. Distelhorst JT, Marcum RE, Klein TA, Kim HC, Lee WJ. Report of two cases of vivax malaria in U.S. soldiers and a review of malaria in the Republic of Korea. *MSMR*. 2014;21(1):8–14.
17. Fairhurst RM, Wellems TE. *Plasmodium* species (malaria). In: Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases (7th Edition). Edited by Mandell GL, Bennett JE, and Dolin R. Churchill Livingstone Elsevier. 2010.

Influenza A(H3N2) Outbreak at Transit Center at Manas, Kyrgyzstan, 2014

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In February 2014, the U.S. Air Force School of Aerospace Medicine Epidemiology Consult Service provided support in response to a moderate outbreak of influenza at the Transit Center at Manas (Kyrgyzstan). A total of 215 individuals presented with influenza-like illness symptoms from 3 December 2013 through 28 February 2014. There were 85 specimens positive for influenza (18 influenza A(H1N1)pdm09, 65 influenza A(H3N2), one influenza A/not subtyped, and one influenza B); six specimens were positive for other respiratory viruses (one human metapneumovirus, two parainfluenza, and three rhinovirus/enterovirus) and eight specimens were negative. Twenty-two of the specimens that were positive for influenza were sequenced and were not remarkably different from the strains seen during routine surveillance for the 2013–2014 season or from specimens collected at other deployed sites.

The high burden of respiratory illness in military populations has been well documented.[1] In fact, respiratory illness is one of the most common causes of lost time from duty among young adults in the military.[2] A number of factors are thought to contribute to this phenomenon, including close-contact training environments, physical and psychological stresses of military training, and service members' immunologic naiveté that could increase vulnerability to infectious disease when first brought together as a group.[2]

In 2012, a cluster of influenza-like illness (ILI) in the 376th Expeditionary Wing at Manas Air Base, Kyrgyzstan, led to the establishment of protocols for shipping viable specimens to the Epidemiology Laboratory at U.S. Air Force School of Aerospace Medicine (USAFSAM) from an area of the globe where routine respiratory surveillance was not otherwise established. After establishing this capacity, 28 viable specimens were successfully delivered to USAFSAM for testing, with influenza A(H3N2) identified as the predominating strain (26 [93%] specimens). The protocols established in 2012 facilitated the collection, shipment, and testing of specimens when the outbreak of ILI described in this report occurred in 2014.

The Transit Center at Manas was a U.S. military installation located at the Manas International Airport near Bishkek, the capital of Kyrgyzstan (official name: Kyrgyz Republic). It was opened in December 2001, following the 11 September 2001 attacks, and was operated by the 376th Air Expeditionary Wing. The 376th Expeditionary Medical Group Public Health Office provided disease surveillance, preventive medicine, and public health services to all personnel assigned to the 376th Expeditionary Wing, tenant units, and coalition forces. The Transit Center at Manas also served as a year-round sentinel site for the Department of Defense (DoD) Global, Laboratory-based, Influenza Surveillance Program. The Center was turned over to the Kyrgyz Republic on 3 June 2014 and U.S. military operations there ceased.

Since 2001, coalition personnel and aircraft from 26 nations operated out of the Transit Center to support operations in Afghanistan. During the period described in this report, approximately 1,500 U.S. military personnel were considered permanent party and were assigned to the wing, along with approximately 900 U.S. and host-nation contractor personnel who provided daily support to various base missions. As the gateway to Afghanistan, the Transit Center averaged 2,000 transient troops per day, each staying approximately 48 hours before going into, and 72 hours after coming out of, Afghanistan.

METHODS

The DoD Global, Laboratory-based, Influenza Surveillance Program is a collaborative program that was formalized in 1999 by the Assistant Secretary of Defense for Health Affairs (DoD Health Affairs Memorandum 99-008). The surveillance program is based on sentinel sites and currently maintains a network of more than 90 such sites. Sentinel sites are requested to submit six to 10 respiratory specimens per week from individuals meeting the ILI case definition. All deployed locations, including the former Manas Air Base, are or were sentinel sites.[3] In 2013, Manas public health confirmed that the installation was still a sentinel site, although the base was in its final transition to closure. Necessary equipment and processes were validated to successfully submit specimens to USAFSAM by collaborating with the laboratory office at Bagram Air Base, Afghanistan (for the purpose of forwarding specimens to Landstuhl Regional Medical Center [LRMC] for testing) and with the Transportation Management Office at Manas.

Case finding

Beginning in early December 2013, Manas clinic providers began to see more permanent and transient party personnel seeking medical attention for ILI. The ILI case definition developed by the DoD Global, Laboratory-based Influenza Surveillance Program is: oral temperature

of 100.5°F or higher and cough or sore throat. However, most patients presenting in Manas had low-grade fever; therefore, providers on 15 January 2014 at Manas modified the case definition to lower the criterion for temperature to 99.0°F or higher. Public Health officials at Manas identified individuals presenting with ILI, and recorded other demographic and clinical information regarding the patients, including squadron, shop, dorm/tent, hospitalization status, influenza vaccine type and date of administration, and date and results of rapid testing for influenza. Vaccination status and date were determined via medical record review.

Control measures

Various preventive measures were implemented at the Transit Center by Public Health, including patient isolation, strict hand washing, cough etiquette, and education/awareness. Isolated patients were not allowed to return to work until they reached the end of the mandatory 7-day exclusion period and had been asymptomatic for at least 24 hours.

Patients were prescribed oseltamivir (an antiviral medication) for influenza treatment at the treating physician's discretion. In some cases, roommates and coworkers of patients were given oseltamivir as a preventative measure. Healthcare workers involved in direct patient care were also offered oseltamivir prophylaxis and advised to wear a protective mask while in the same room as any patient exhibiting respiratory symptoms. While collecting nasal wash specimens, each technician wore a mask, gown, gloves, and eye protection.

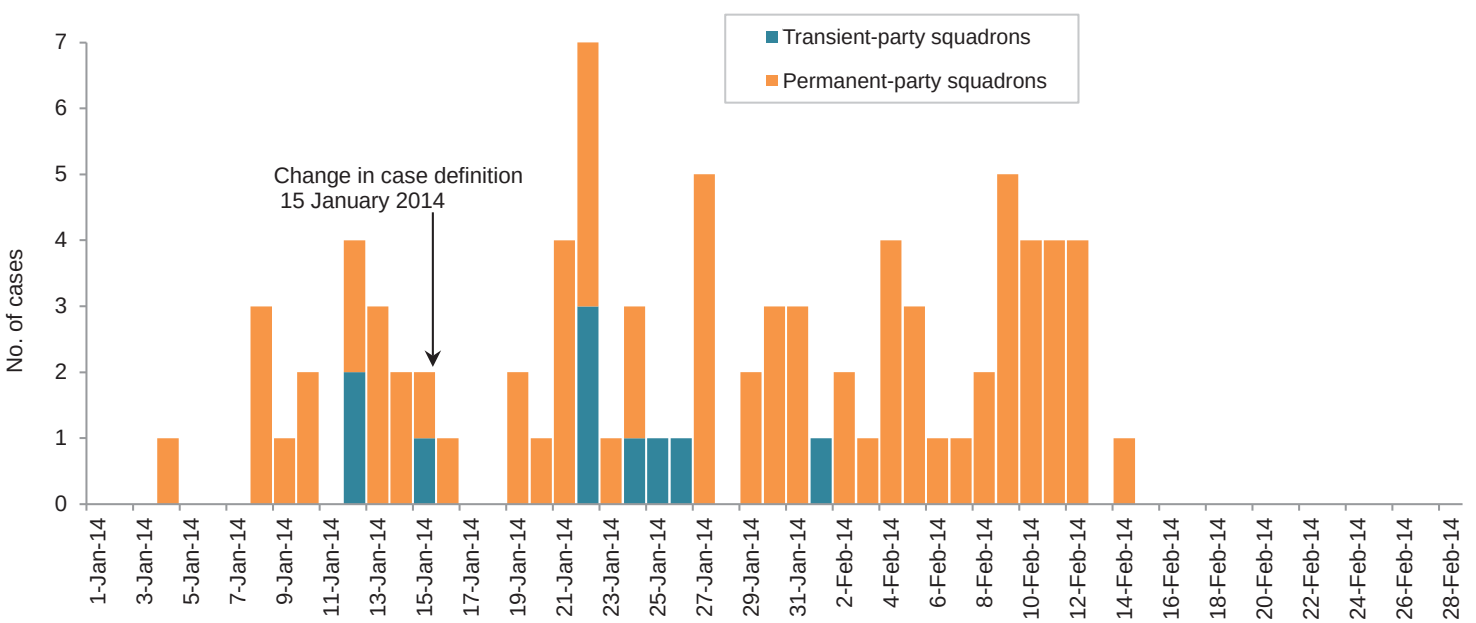
During the height of the outbreak and well beyond the identification of the final cases, correspondence between USAFSAM Epidemiology Consult Service and Public Health at Manas was constant to assure logistics support for specimen shipment, laboratory test results, and epidemiologic analysis support.

RESULTS

A total of 215 individuals met the previously described ILI case definitions from 3 December 2013 to 28 February 2014. Prior to the first laboratory-confirmed positive case of influenza, there were seven ILI cases in December and one in January. The first laboratory-confirmed positive case of influenza was seen on 4 January 2014 **(Figure 1)**. Of the 215 patients identified, 86 met the altered ILI case definition implemented by Manas providers, as these individuals presented with low-grade fever (average temperature 99.6°F). Out of all ILI cases (n=215), three were hospitalized and each had a fever of 100.5°F or higher. Final laboratory results for specimens from these three patients were: one positive for influenza A(H1N1)pdm09, one negative, and one untestable specimen.

All patients presenting with ILI received a rapid flu test; rapid test results showed that 69 (32.1%) were positive for influenza (65 A, two B, and two unknown) and 146 were negative. Nasal wash specimens were collected on 111 (51.6%) individuals and 99 specimens were tested at LRMC. Patients with a positive rapid test (n=69), meeting either ILI case definition with a negative rapid test (n=23), or suspected to have influenza by a providing clinician (n=19) submitted a nasal wash. Of the 111 nasal wash specimens, 12 were not tested at LRMC due to transportation issues (n=9), a freezer outage (n=2), or improper accessioning (n=1). Eighty-five (76.6%) specimens were positive for influenza, including 18 A(H1N1)pdm09 (21.2%), 65 A(H3N2) (76.5%), one A/not subtyped (1.2%), and one B (1.2%). Seven with positive influenza tests had co-infections: one

FIGURE 1. Laboratory-confirmed influenza cases by date and personnel party, Manas Transit Center, January 2014–February 2014

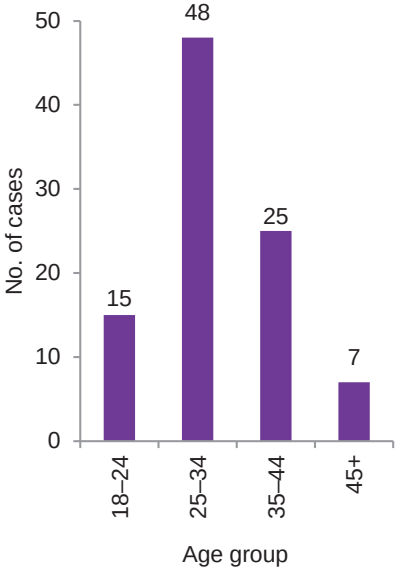


influenza A(H1N1)pdm09 and respiratory syncytial virus, five influenza A(H3N2) and rhinovirus/enterovirus, and one A(H3N2) and human metapneuomovirus. Six (5.4%) specimens were positive for other respiratory viruses, including one human metapneumovirus, two parainfluenza, and three rhinovirus/enterovirus. Eight (7.2%) specimens were determined to be negative.

Descriptive epidemiology

Not all descriptive data were complete for the 111 cases who submitted nasal wash specimens. Cases with unit information available (n=99) were spread among 30 squadrons (18 permanent party squadrons and 12 transient squadrons) and were seen in mostly permanent party personnel (88%). Of the 101 cases with data on their sex, 80% were males. The average age of cases with known age (n=95) was 32 years, and ages ranged from 20 to 56 years **(Figure 2)**. All cases had been vaccinated by live attenuated influenza vaccine (LAIV) (n=70) or inactivated influenza vaccine (IIV) (n=41). There was an average of 18 weeks from vaccination to illness onset (n=96; range 6–31 weeks) **(Figure 3)**.

FIGURE 2. Number of laboratory-confirmed influenza cases by age group, Manas Transit Center, January 2014–February 2014



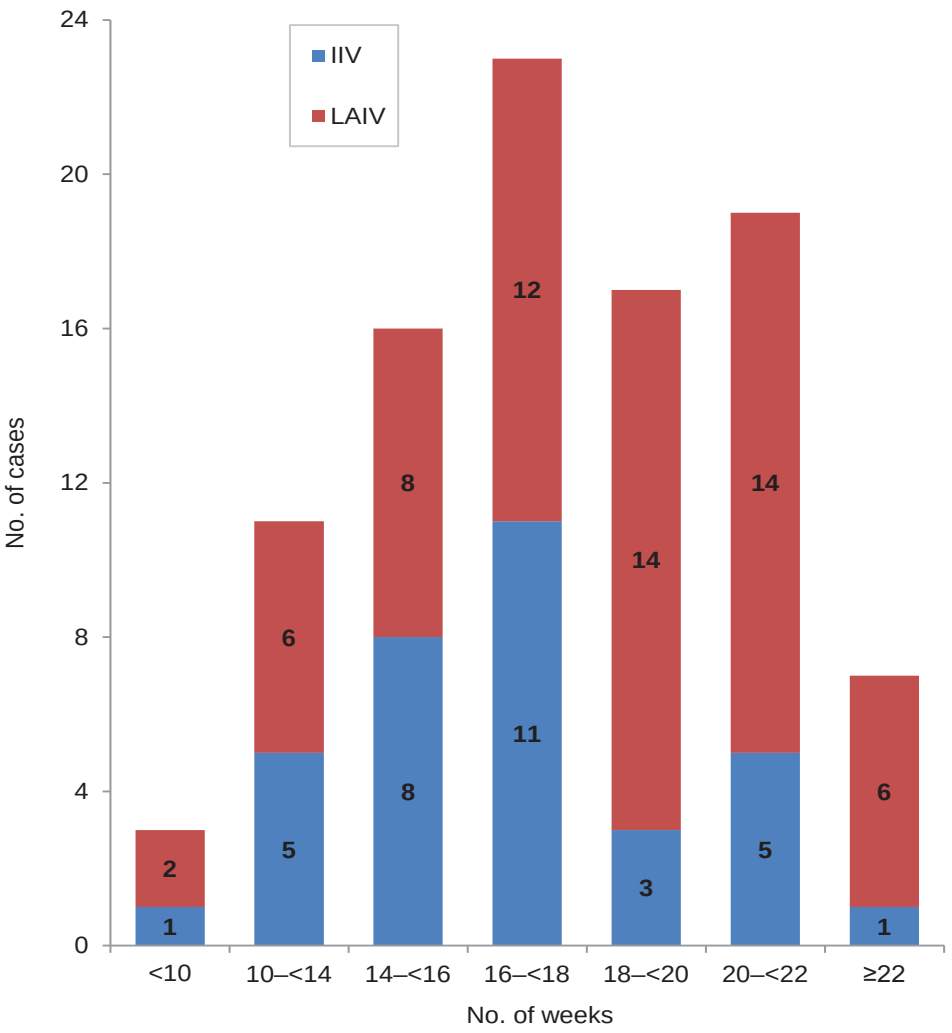
Molecular sequencing results

Among specimens positive for influenza, 3 influenza A(H1N1)pdm09, 18 influenza A(H3N2) and 1 influenza B were sequenced. The influenza B specimen characterized as a Yamagata lineage was similar to the majority of influenza B specimens characterized during the 2013–2014 season. The influenza A(H1N1)pdm09 specimens were also characterized in the predominant group of influenza A(H1N1)pdm09 for the season. The 18 influenza A(H3N2) specimens clustered into a group that included the majority of A(H3N2) specimens characterized by USAFSAM surveillance, which were distinguished by two point mutations. Furthermore, the influenza A(H3N2) specimens all shared an additional point mutation and clustered with other specimens collected at deployed sites.

EDITORIAL COMMENT

This report documents a moderate outbreak of ILI that affected transient and permanent party personnel at the Transit Center at Manas. Investigation did not reveal a source of influenza introduction into the population. It is possible that

FIGURE 3. Number of weeks from influenza vaccination to illness onset by vaccine type, Manas Transit Center, January 2014–February 2014



IIV=inactivated influenza vaccine; LAIV=live, attenuated influenza vaccine

many infected individuals had mild symptoms and no fever; such persons might never have sought medical attention but continued to carry out their normal activities while infectious, aiding in the person-to-person spread of the influenza virus. Although data are not available to retrospectively determine how many additional ILI cases would have been added with earlier adoption of the altered ILI case definition, it is not expected that the number of cases would have increased dramatically because providers identified early in the outbreak that the temperature criterion needed to be reduced before the altered ILI case definition was formally applied. The multipeaked epidemic curve was driven primarily by the permanent party personnel and cannot be fully attributed to the rapid movement of troops both into and out of the Transit Center **(Figure 1)**.

With the objectives of preserving readiness and enhancing force health protection, annual vaccination against influenza is mandatory, but past vaccine effectiveness analyses have shown lower vaccine effectiveness among military personnel than civilians and dependents.[4,5] Repeat vaccination may be a contributing factor; immunogenicity studies have shown attenuated immunologic response with repeated vaccine receipt. In addition, immunologic response may vary based on the degree of similarity between vaccine strains across years.[6]

In this outbreak, all cases had been vaccinated with either IIV or LAIV. Although no evidence has been found to support this, it is possible that vaccination against influenza contributed to the decreased severity of illness among cases. Further research to understand the effect of vaccination on symptom severity among flu cases is warranted to further elucidate these findings. The majority of cases were seen 4 months or more after vaccination, suggesting that waning immunity may have played a role in this outbreak. Recent studies suggest that time since vaccination may be associated with risk of influenza infection, suggesting the plausibility of waning vaccine induced protection against influenza over time.[7,8]

In Asia, according to World Health Organization reports, both influenza A(H1N1)pdm09 and A(H3N2) viruses were circulating during the time of this outbreak.[9] This is consistent with the distribution of results at Manas. As the gateway to Afghanistan, there was constant mixing of individuals at Manas; an outbreak in this environment is not surprising.

Although most sequenced cases of influenza followed molecular patterns found in other parts of the world, the influenza A(H3N2) found in the Manas Transit Center was distinguished by two point mutations. This finding supports the premise that novel or emerging strains from geographically diverse populations could be detected with molecular sequencing laboratory techniques, though novel strains were not detected in this outbreak.

In the future, all sentinel sites, especially deployed locations and sites resembling Manas Air Base, should be prepared to conduct influenza surveillance prior to the start of flu season and to respond quickly in an outbreak situation. The Manas Transit Center outbreak is an example of how an influenza outbreak may not be associated with high fever in DoD populations; therefore, implementation of surveillance with higher sensitivity case definitions may be necessary to identify cases. The DoD Global, Laboratory-based, Influenza Surveillance Program is dedicated to ensuring force health protection and decreasing influenza morbidity. Deployed and other sites should contact program personnel for support when an outbreak is recognized.

Disclaimer: The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the U.S. Air Force, the Department of Defense, or the U.S. Government.

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Acknowledgments: The authors thank Col James Knowles, Lt Col Dwight Peake, Maj Connie Winik, Capt David Bereda, TSgt Jean Risinger, Lt Col Miriam Montes, LTC Edward Ager, MAJ JR Managbanag, Dr. Elizabeth Macias, Maj Robel Yohannes, and Mr. Benjamin Connors for their cooperation and assistance.

REFERENCES

1. Russell KL, Hawksworth AW, Ryan MA, et al. Vaccine-preventable adenoviral respiratory illness in U.S. military recruits, 1999–2004. *Vaccine*. 2006;24(15):2835–2842.
2. Ryan MA, Christian RS, Wohlrabe J. Handwashing and respiratory illness among young adults in military training. *Am J Prev Med*. 2011;21(2):79–83.
3. McIntosh V, Noe J, Zorich S, et al. The Department of Defense Global, Laboratory-based Influenza Surveillance Program: Technical Report on Program Methods for the 2012–2013 Influenza Season. http://www.dtic.mil/get-tr-doc/pdf?AD=ADA599690. Published 1 October 2013. Accessed on 8 May 2014.
4. Eick-Cost A, Hu Z, Cooper MJ, et al. Mid-season influenza vaccine effectiveness for the 2012–2013 influenza season. *MSMR*. 2013;20(3):15–16.
5. Cost A, Hiser MJ, Hu Z, et al. Brief report: Mid-season influenza vaccine effectiveness estimates for the 2013–2014 influenza season. *MSMR*. 2014;21(6):15–17.
6. Ohmit SE, Petrie JE, Malosh RE, et al. Influenza Vaccine Effectiveness in the Community and the Household. *Clin Infect Dis*. 2013;56(10):1363–1369.
7. Belongia EA, Sundaram ME, McClure DL, et al. Waning vaccine protection against influenza A(H3N2) illness in children and older adults during a single season. *Vaccine*. 2015;33(1):246–251.
8. Kissling E, Valenciano M, Laurraui A, et al. Low and decreasing vaccine effectiveness against influenza A(H3) in 2011/12 among vaccination target groups in Europe: results from the I-MOVE multicentre case-control study. *Euro Surveill*. 2013;15(5):33–42.
9. Influenza Update.World Health Organization website. http://www.who.int/influenza/surveillance_monitoring/updates/latest_update_GIP_surveillance/en/index.html. Accessed on 9 January 2014.

Incidence of *Salmonella* Infections Among Service Members of the Active and Reserve Components of the U.S. Armed Forces and Among Other Beneficiaries of the Military Health System, 2000–2013

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This report reviews the incidence of cases of typhoidal and non-typhoidal *Salmonella* infections based on diagnoses recorded in healthcare records and reported through the Armed Forces reportable medical event (RME) system. During 2000–2013, there were 1,815 incident cases of non-typhoidal *Salmonella* and 456 incident cases of typhoidal *Salmonella* diagnosed in the active component force. The crude incidence rate for non-typhoidal *Salmonella* was 0.91 cases per 10,000 person years (p-yrs) and the rate for typhoidal *Salmonella* was 0.23 cases per 10,000 p-yrs. Among retirees and family members, children under 5 years of age and those aged 75 years or older comprised the greatest number of non-typhoidal *Salmonella* cases. Preventive measures for reducing the risk of infection with *Salmonella* are discussed.

Salmonella is a group of gram-negative bacteria that can infect both animal and human hosts. These bacteria cause several conditions in humans, including acute gastroenteritis and enteric fever. The species of the bacterial genus *Salmonella* most often associated with human disease is *Salmonella enterica*. Serotypes *S.* Typhi and *S.* Paratyphi are the etiologic agents for enteric fever, the prototype of which is typhoid fever caused by *S.* Typhi.[1] In the U.S., the most common serotypes isolated in cases of non-typhoidal *Salmonella* infection are *S.* Enteritidis, *S.* Typhimurium, and *S.* Newport.

Non-typhoidal *Salmonella* species represent the leading bacterial cause of foodborne illness in the U.S. It is estimated that more than 1 million cases occur annually in the U.S.; of these, about 42,000 laboratory-confirmed cases are reported each year to the Centers for Disease Control and Prevention (CDC).[2] Within members of the active component of the U.S. Armed Forces, *Salmonella* is a leading cause of acute gastrointestinal illness.[3] Typhoid fever, in contrast, is relatively rare in the U.S., with approximately 1,800 estimated cases annually; however, it remains a significant global public health problem. Worldwide, more than 20 million cases of typhoid fever occur annually and another 5.5 million cases of enteric fever are attributed to *S.* Paratyphi.[1]

The most common presentation of illness in non-typhoidal *Salmonella* is gastroenteritis with typical signs and symptoms of diarrhea, fever, and abdominal cramps. It is spread primarily via contaminated food (common sources includes poultry and eggs), but can also be transmitted via animal contact (e.g., lizards, turtles, frogs, chickens). The most common signs of illness in typhoid fever are sustained fever, malaise and fatigue, abdominal pains, headache, and/or loss of appetite. Because *S.* Typhi and *S.* Paratyphi have no known hosts other than humans, enteric fever is usually spread via contact with an infected person or via food or water contaminated by the feces of an infected person.[1] Antimicrobial resistance in both typhoidal and non-typhoidal *Salmonella* has been increasing both in the U.S, and globally. Of non-typhoidal *Salmonella* specimens tested by the CDC, about 5% are resistant to five or more antibiotic classes, while 67% of *S.* Typhi tested demonstrated resistance to ciprofloxacin.[4]

This report reviews the incidence of diagnoses of *Salmonella* infections in service members and other beneficiaries of the Military Health System (MHS) over the past 14 years.

METHODS

The surveillance period was 1 January 2000 through 31 December 2013. Three separate populations were examined for incident cases of *Salmonella* infection. The first surveillance population consisted of all active component service members of the U.S. Armed Forces who served at any time during the surveillance period. For this population, the availability of personnel data about time in service and other demographic information enabled the calculation of incidence rates based on person-time in service. The other populations considered separately were members of the reserve component (Reserve and National Guard) and other beneficiaries (retirees and family members) of the MHS. For the latter two populations, data for person-time were not available for calculation of incidence rates, so only counts of cases are described.

Diagnoses of *Salmonella* infection were derived from records of reports of notifiable medical events and from administrative records of all medical encounters of individuals who received care in fixed (i.e., not deployed or at sea) medical facilities of the MHS or civilian facilities in the purchased care system. All such records are maintained in the electronic records of Defense Medical Surveillance System (DMSS). For surveillance purposes, an incident case of non-typhoidal *Salmonella* infection was defined on the basis of a reportable medical event (RME) record of "confirmed"

Salmonella infection or a record of one inpatient or one outpatient encounter documented with any of the diagnostic codes falling under ICD-9 code 003, "Other salmonella infections." For typhoid or paratyphoid salmonellosis, an incident case was defined by an RME record of a confirmed typhoid fever case or a record of one inpatient or outpatient medical encounter where any of the diagnostic codes fell under ICD-9 code 002, "Typhoid and paratyphoid fevers." An individual could be considered a case once every 180 days.

RESULTS

Active component

During the 14-year surveillance period, there were 2,271 incident cases of *Salmonella* infection in active component members; of these, 1,815 were non-typhoidal *Salmonella* and 456 infections were for typhoid/paratyphoid fever. The overall incidence rate for non-typhoidal *Salmonella* was 0.91 cases per 10,000 person-years (p-yrs). The overall incidence for typhoid/paratyphoid fever was 0.23 per 10,000 p-yrs **(Table 1)**. The overall incidence rates of both typhoidal and non-typhoidal *Salmonella* infection were higher in female service members than males. Those aged 35–44 years had the highest rates of typhoidal *Salmonella,* while active component members aged 25–29 years had the highest rates of non-typhoidal *Salmonella.* Members of the Army and junior officers had the highest rates of non-typhoidal *Salmonella* infection. Rates for typhoidal *Salmonella* were lowest among black, non-Hispanic service members compared to the other race/ethnicity groups, and rates for non-typhoidal *Salmonella* were highest in white, non-Hispanic service members **(Table 1)**. It is noteworthy that the numbers and annual incidence rates of cases of both typhoidal and non-typhoidal *Salmonella* infection were highest in the earliest part of the surveillance period, with the peak incidence for non-typhoidal *Salmonella* infection occurring in 2001 (1.3 cases per 10,000 p-yrs) and the peak for typhoidal *Salmonella* occurring in 2000 (0.7 per 10,000 p-yrs) **(Figure 1)**. Incidence rates remained generally stable with variable increases and decreases until a sharp increase in non-typhoidal *Salmonella* in 2011 to 1.1 cases per 10,000 p-yrs. Incidence rates declined in the subsequent 2 years.

Reserve component

A total of 395 incident cases of *Salmonella* infection were identified among members of the reserve component during the 14-year surveillance period. More than three-quarters of these cases (n=305) were non-typhoidal *Salmonella*. Because it was not possible to calculate incidence rates for this population, the distribution of diagnoses by demographic characteristics cannot be readily compared to the distribution among members of the active component. However, the preponderance of cases among members of the reserve component occurred among white, non-Hispanics (69%) and members of the Army (70%) **(Table 1)**. Counts of non-typhoidal *Salmonella* declined slightly in 2013 (n=23), following the years 2010–2012 when average annual case counts (35.7 cases per year) were more than twice the average counts for 2004–2009 (14.7 cases per year) **(Figure 2)**.

TABLE 1. Incident cases and incidence rates of salmonellosis, active and reserve components, U.S. Armed Forces, 2000–2013

	Non-typhoidal salmonellosis			Typhoid/paratyphoid salmonellosis		
	Active component		Reserve component	Active component		Reserve component
	No.	Rate[a]	No.	No.	Rate[a]	No.
Total	1,815	0.91	305	456	0.23	90
Sex						
Male	1,462	0.86	239	373	0.22	74
Female	353	1.22	66	83	0.29	16
Age group						
<20	249	0.92	34	41	0.15	8
20–24	503	0.95	48	115	0.22	18
25–29	449	1.01	61	97	0.22	15
30–34	258	0.87	40	76	0.26	7
35–39	182	0.73	40	74	0.30	9
40–44	122	0.86	38	43	0.30	18
45–49	42	0.82	26	7	0.14	4
50+	10	0.58	18	3	0.17	11
Race/ethnicity						
White, non-Hispanic	1,230	0.98	207	303	0.24	66
Black, non-Hispanic	267	0.78	36	57	0.17	5
Hispanic	156	0.75	35	46	0.22	14
Other	162	0.81	27	50	0.25	5
Service						
Army	772	1.08	217	117	0.16	60
Navy	307	0.64	28	125	0.26	9
Air Force	475	0.99	47	169	0.35	16
Marine Corps	206	0.79	13	34	0.13	5
Coast Guard	55	0.99	.	11	0.20	.
Rank						
Junior enlisted (E1–E4)	815	0.93	103	182	0.21	35
Senior enlisted (E5–E9)	671	0.85	154	194	0.24	42
Junior officer (O1–O4)	255	1.05	26	61	0.25	10
Senior officer (O5–O11)	53	0.9	10	12	0.20	1
Warrant officer (W1–W5)	21	0.8	12	7	0.27	2

[a]Rate per 10,000 person-years

FIGURE 1. Annual numbers of incident cases and incidence rates of typhoidal and non-typhoidal salmonellosis, active component, U.S. Armed Forces, 2000–2013

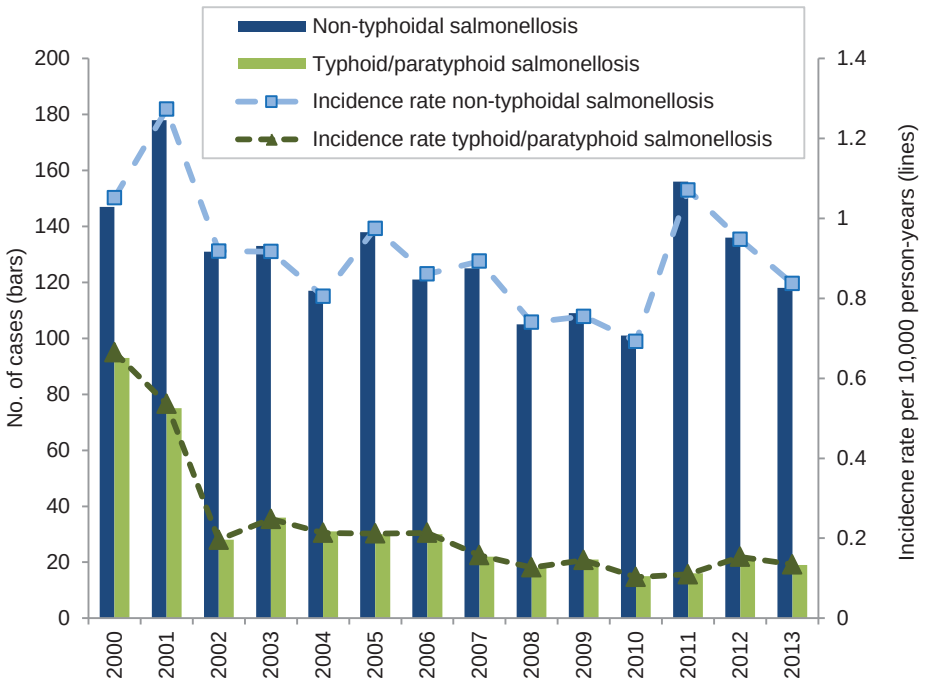
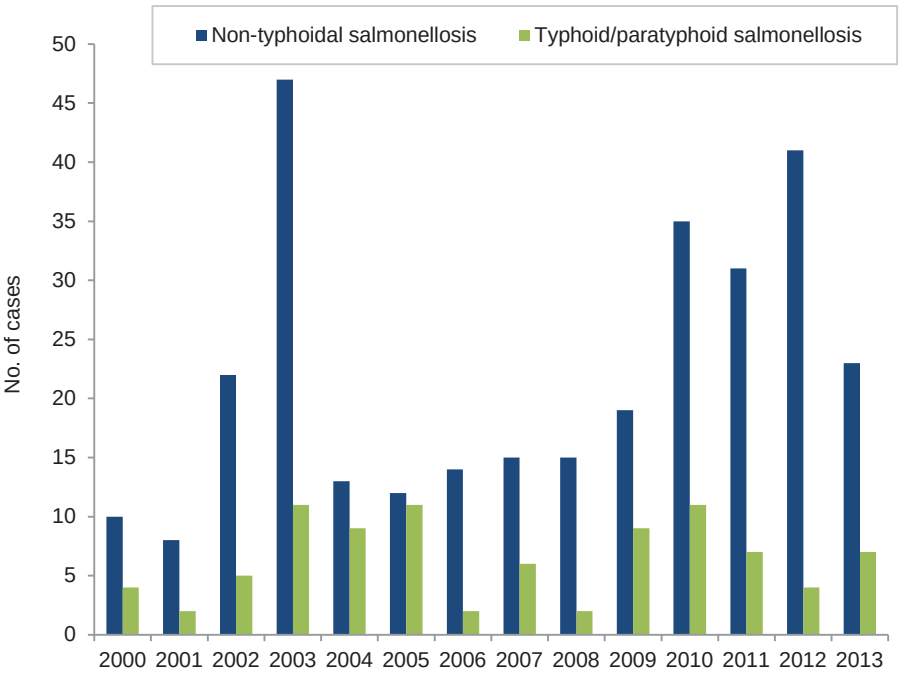


FIGURE 2. Annual numbers of incident cases of salmonellosis, reserve component, U.S. Armed Forces, 2000–2013



Other beneficiaries

The population of other beneficiaries differs considerably from that of service members (both active and reserve components) with respect to several demographic characteristics. Notably, there are many more "other beneficiaries" (7.3 million, of whom at least 5.3 million are enrolled in TRICARE) than there are service members (2.3 million).[5] Moreover, there are many other beneficiaries aged 17 years or younger, many aged 60 years or older, and a much greater proportion of females than is the case with service members. During the surveillance period, there were 16,033 incident cases of *Salmonella* infection among other beneficiaries; more than two-thirds (69.3%) represented non-typhoidal *Salmonella* infections **(Table 2)**. Cases among females accounted for 56.4% and 54.4% of all cases of non-typhoidal and typhoidal *Salmonella*, respectively. The age groups with the largest numbers of cases were the youngest and the oldest **(Table 2, Figure 3)**. The annual numbers of cases of all *Salmonella* infections have declined since 2008 **(Figure 4).**

EDITORIAL COMMENT

Among active component service members of the Armed Forces, the overall incidence rate of non-typhoidal *Salmonella* was 0.9 per 10,000 p-yrs and the peak annual incidence rate was 1.3 cases per 10,000 p-yrs in 2001. Crude annual incidence rates reached a nadir in 2010 (0.7 per 10,000 p-yrs) and then rose slightly in 2011 before declining again in 2012 and 2013. The overall incidence rate for typhoidal salmonellosis was 0.2 cases per 10,000 p-yrs and the peak annual incidence rate was in 2000 (0.7 per 10,000 p-yrs). Crude annual incidence rates steadily declined until 2008 and have since plateaued.

The data on non-typhoidal *Salmonella* infections among other MHS beneficiaries mirror similar trends in the general U.S. population. The numbers of cases in children aged 5 years or younger and in those aged 75 years or older are higher than other age groups. A similar pattern is seen with typhoidal *Salmonella* with increased case numbers in children and adolescents and those aged 75 years or older. The decrease in *Salmonella* infections in 2013 compared to the previous 2 years is similar to the trend reported in the U.S. general population.

In 2013, the estimated *Salmonella* incidence rate in the U.S. population was 15.19 per 100,000 people, a level above the *Healthy People 2020* national goal of 4 cases per 100,000 people.[6] In contrast, the incidence rates in this report for active component

TABLE 2. Incident cases of salmonellosis, other Military Health System beneficiaries, 2000–2013

	Non-typhoidal salmonellosis		Typhoid/paratyphoid salmonellosis	
	No. of cases	% total	No. of cases	% total
Total	11,109	100.0	4,924	100.0
Sex				
Male	4,848	43.6	2,247	45.6
Female	6,261	56.4	2,677	54.4
Age				
0–4	3,965	35.7	839	17.0
5–9	914	8.2	319	6.5
10–14	572	5.1	300	6.1
15–19	572	5.1	236	4.8
20–24	411	3.7	158	3.2
25–29	323	2.9	104	2.1
30–34	283	2.5	94	1.9
35–39	274	2.5	106	2.2
40–44	312	2.8	137	2.8
45–49	427	3.8	253	5.1
50–54	465	4.2	266	5.4
55–59	483	4.3	326	6.6
60–64	514	4.6	399	8.1
65–69	478	4.3	321	6.5
70–74	407	3.7	364	7.4
75+	709	6.4	702	14.3

FIGURE 3. Age distribution of incident cases of salmonellosis among other Military Health System beneficiaries, 2000–2013

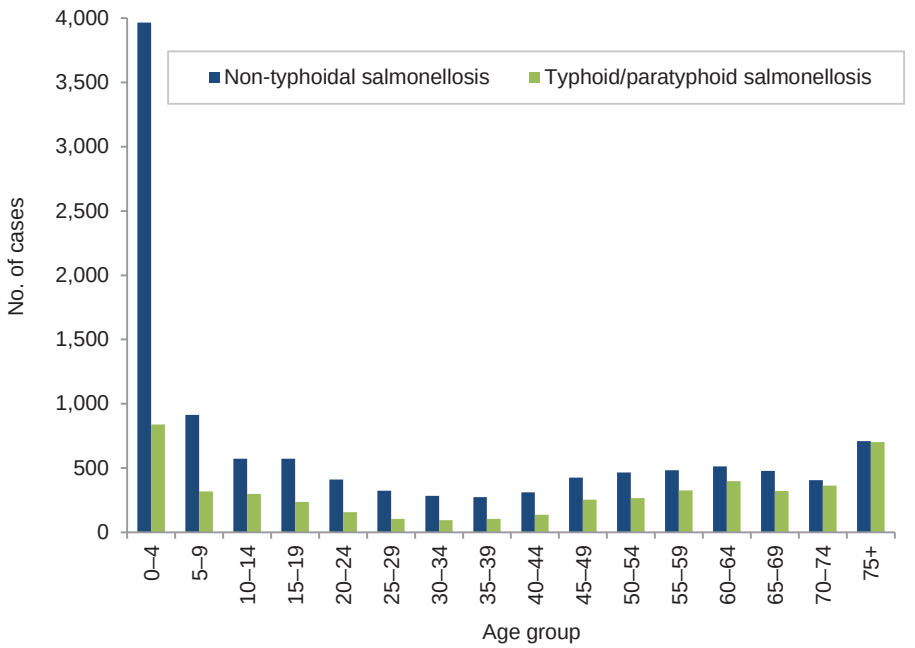
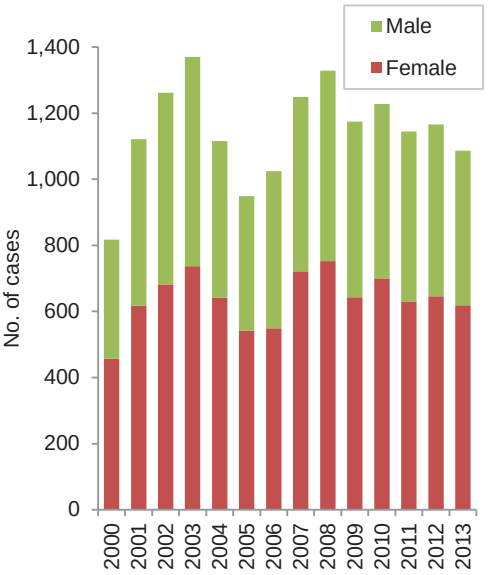


FIGURE 4. Annual numbers of incident cases of salmonellosis among other Military Health System beneficiaries, by gender, 2000–2013



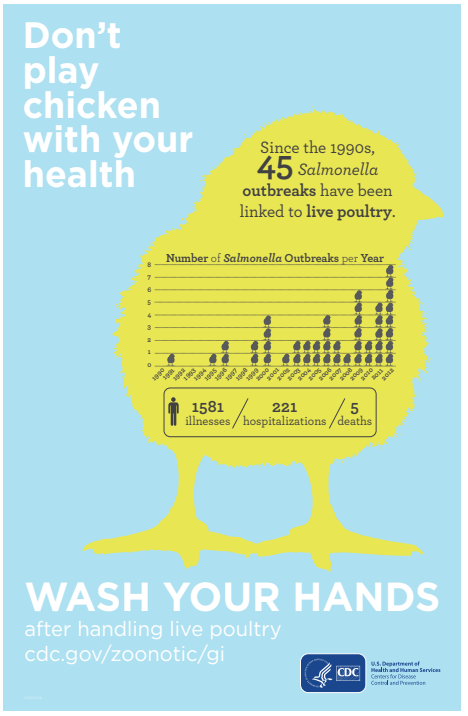
military rates would roughly equate to 9.1 per 100,000 people, which, while lower than the U.S. general population rate, still is above the national goal set for this pathogen.

One limitation of this analysis is that *Salmonella* cases diagnosed while individuals were deployed were not included in these analyses, unless the case was reported through the RME system. This undoubtedly resulted in an underestimate of the incidence rate of *Salmonella* in active component military members.

The majority of reported *Salmonella* outbreaks are foodborne. Many foodborne *Salmonella* infections can be prevented through standard measures such as hand washing; thorough cleaning of cooking surfaces and utensils; appropriate storage of food; and, as appropriate, cooking foods thoroughly, especially poultry. In addition, an increasing number of outbreaks have been linked to the handling of reptiles and amphibians; most recently, 166 cases (37% hospitalized) in 36 states were linked to pet bearded dragons.[7] Increased awareness about the risk of contracting *Salmonella* via this mechanism should be fostered, especially in parents of children aged 5 years or younger and in those with compromised immune systems. Similar education about the risk of *Salmonella* infection through the handling of live poultry is also warranted.

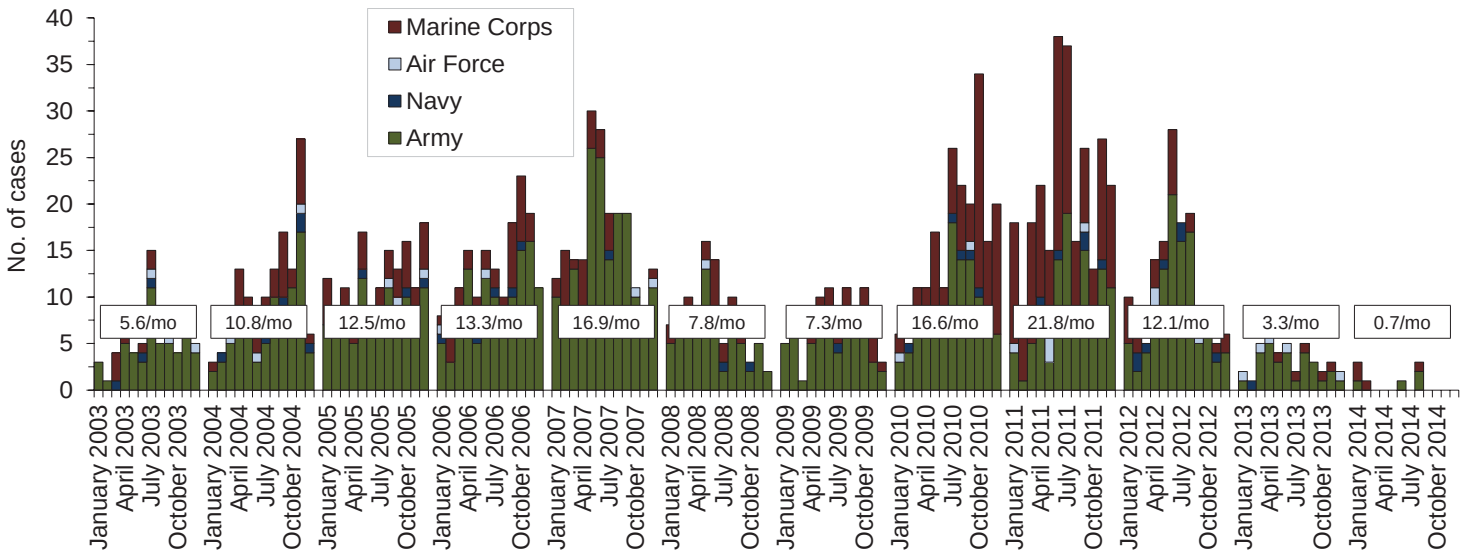
REFERENCES

1. Pegues DA and Miller SI. *Salmonella* Species, Including *Salmonella* Typhi and related species. In Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases (7th Edition). Edited by Mandell GL, Bennett JE, and Dolin R. Churchill Livingstone Elsevier. 2010.
2. Scallan E, Hoekstra RM, Angulo FJ, et al. Foodborne illness acquired in the United States–major pathogens. *Emerg Inf Dis.* 2011;17(1):7–15.
3. Armed Forces Health Surveillance Center. Gastrointestinal infections, active component, U.S. Armed Forces, 2002–2012. *MSMR*. 2013;20(10): 7–11.
4. Centers for Disease Control and Prevention. Drug-resistant non-typhoidal *Salmonella*. http://www.cdc.gov/drugresistance/threat-report-2013/pdf/ar-threats-2013-508.pdf#page=71. Accessed on 26 January 2015.
5. Department of Defense. Evaluation of the TRICARE Program. Fiscal Year 2014 Report to Congress. 5 March 2014. http://www.health.mil/ Reference-Center/Reports/2014/02/25/2014-Evaluation-of-the-TRICARE-Program-Report-to-Congress. Accessed on 10 December 2014.
6. Crim SM, Iwamoto M, Huang JY, et al. Incidence and trends of infection with pathogens transmitted commonly through food—Foodborne Diseases Active Surveillance Network, 10 U.S. sites, 2006–2013. *MMWR*. 2014; 63(15):328–332.
7. Centers for Disease Control and Prevention. Multistate outbreak of human *Salmonella* Cotham and *Salmonella* Kisarawe infections linked to contact with pet bearded dragons (Final update). http://www.cdc.gov/salmonella/cotham-04-14/index.html. Accessed on 26 January 2015.



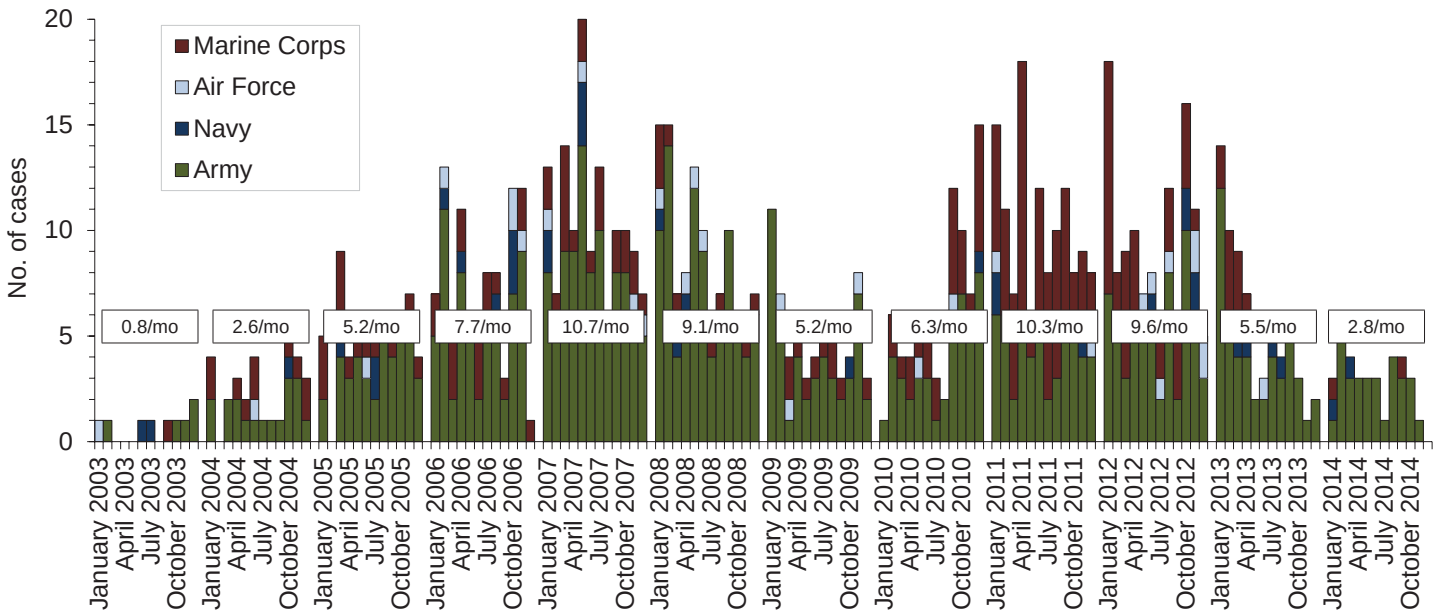
Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003–December 2014 (data as of 20 January 2015)

Amputations (ICD-9-CM: 887, 896, 897, V49.6 except V49.61–V49.62, V49.7 except V49.71–V49.72, PR 84.0–PR 84.1, except PR 84.01–PR 84.02 and PR 84.11)[a]



Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: amputations. Amputations of lower and upper extremities, U.S. Armed Forces, 1990–2004. *MSMR*. Jan 2005;11(1):2–6.
[a]Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 365 days of returning from deployment.

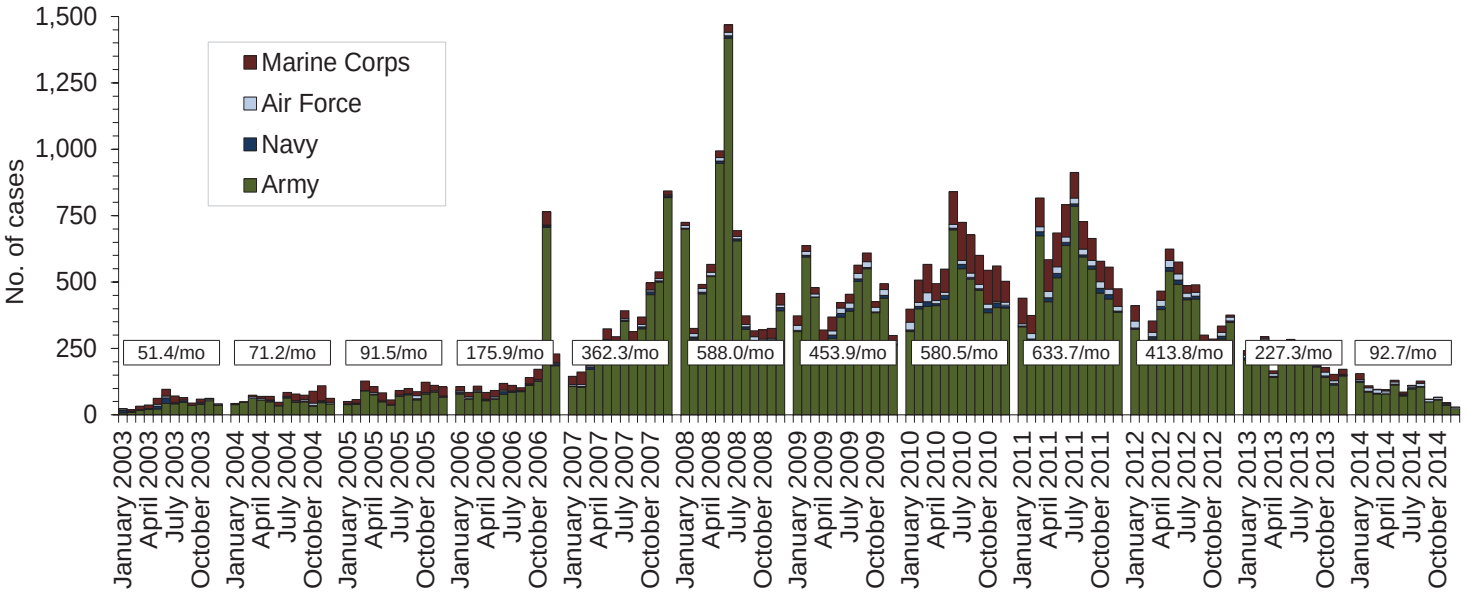
Heterotopic ossification (ICD-9: 728.12, 728.13, 728.19)[b]



Reference: Army Medical Surveillance Activity. Heterotopic ossification, active components, U.S. Armed Forces, 2002–2007. *MSMR*. Aug 2007; 14(5):7–9.
[b]One diagnosis during a hospitalization or two or more ambulatory visits at least 7 days apart (one case per individual) while deployed to/within 365 days of returning from deployment.

Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003–December 2014 (data as of 20 January 2015)

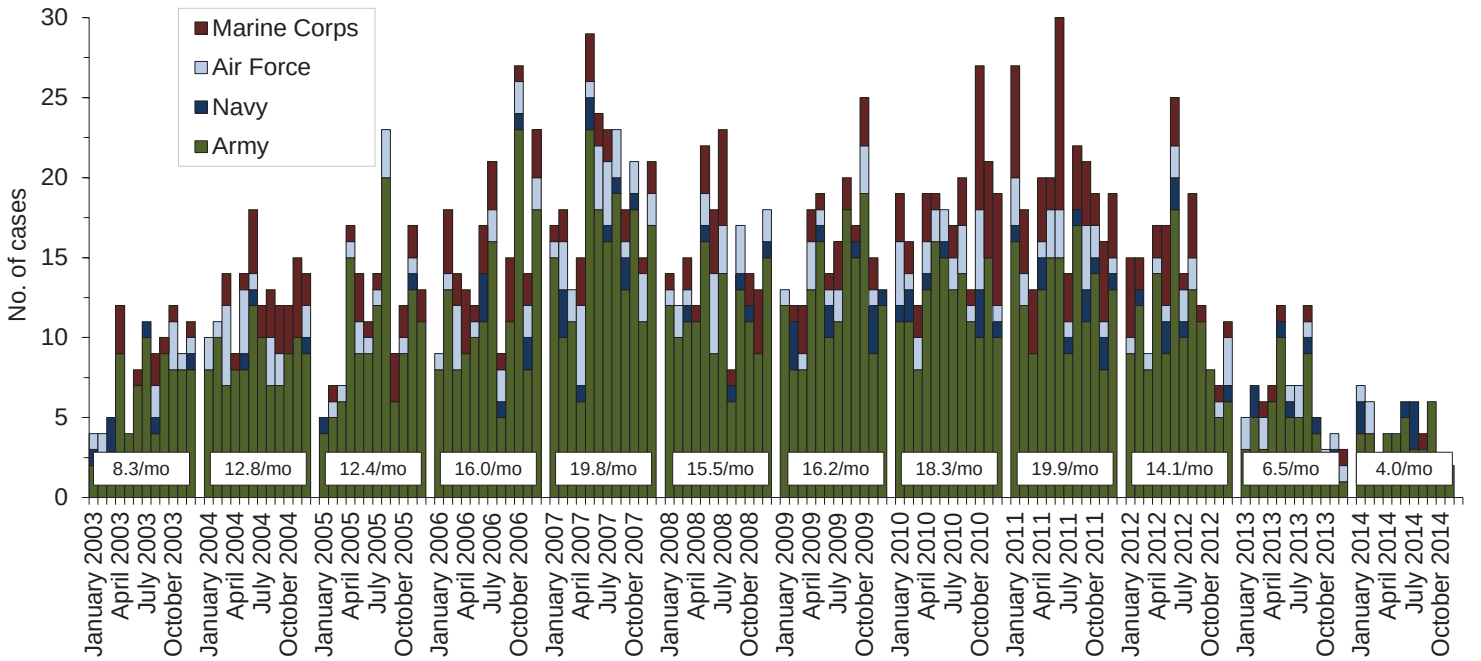
Traumatic brain injury (TBI) (ICD-9: 310.2, 800–801, 803-804, 850–854, 907.0, 950.1–950.3, 959.01, V15.5_1–9, V15.5_A–F, V15.52_0–9, V15.52_A–F, V15.59_1–9, V15.59_A–F)[a]



Reference: Armed Forces Health Surveillance Center. Deriving case counts from medical encounter data: considerations when interpreting health surveillance reports. *MSMR*. 2009; 16(12):2–8.

[a]Indicator diagnosis (one per individual) during a hospitalization or ambulatory visit while deployed to/within 30 days of returning from deployment (includes in-theater medical encounters from the Theater Medical Data Store [TMDS] and excludes 4,529 deployers who had at least one TBI-related medical encounter any time prior to deployment).

Deep vein thrombophlebitis/pulmonary embolus (ICD-9: 415.1, 451.1, 451.81, 451.83, 451.89, 453.2, 453.40–453.42 and 453.8)[b]

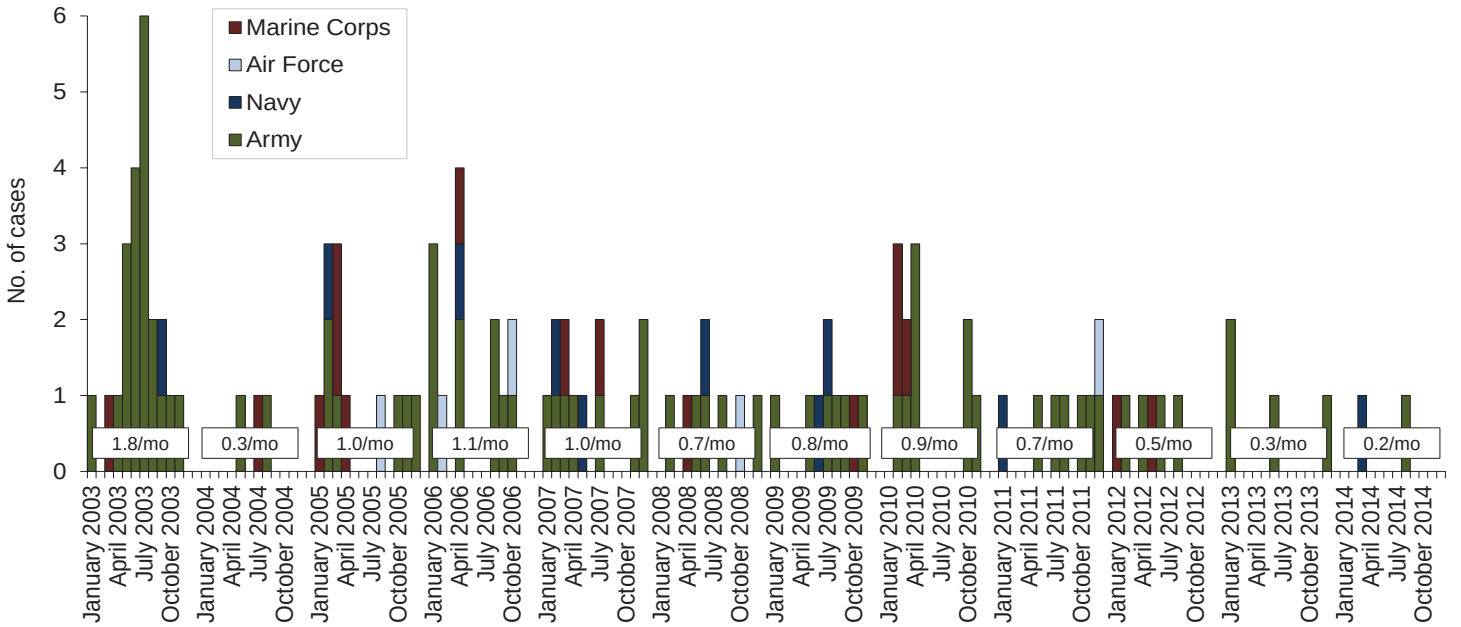


Reference: Isenbarger DW, Atwood JE, Scott PT, et al. Venous thromboembolism among United States soldiers deployed to Southwest Asia. *Thromb Res*. 2006;117(4):379–383.

[b]One diagnosis during a hospitalization or two or more ambulatory visits at least 7 days apart (one case per individual) while deployed to/within 90 days of returning from deployment.

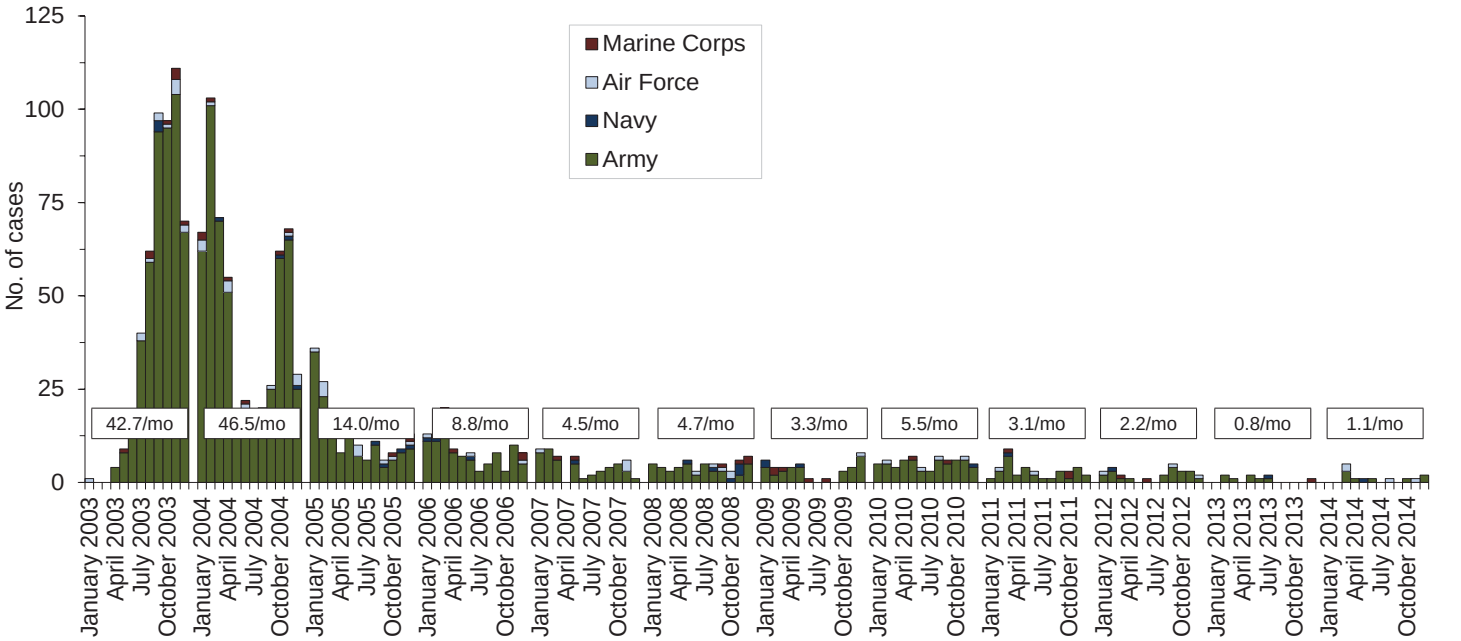
Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003–December 2014 (data as of 20 January 2015)

Severe acute pneumonia (ICD-9: 518.81, 518.82, 480–487, 786.09)[a]



Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: severe acute pneumonia. Hospitalizations for acute respiratory failure (ARF)/acute respiratory distress syndrome (ARDS) among participants in Operation Enduring Freedom/Operation Iraqi Freedom, active components, U.S. Armed Forces, January 2003–November 2004. *MSMR*. Nov/Dec 2004;10(6):6–7.
[a]Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 30 days of returning from OEF/OIF/OND.

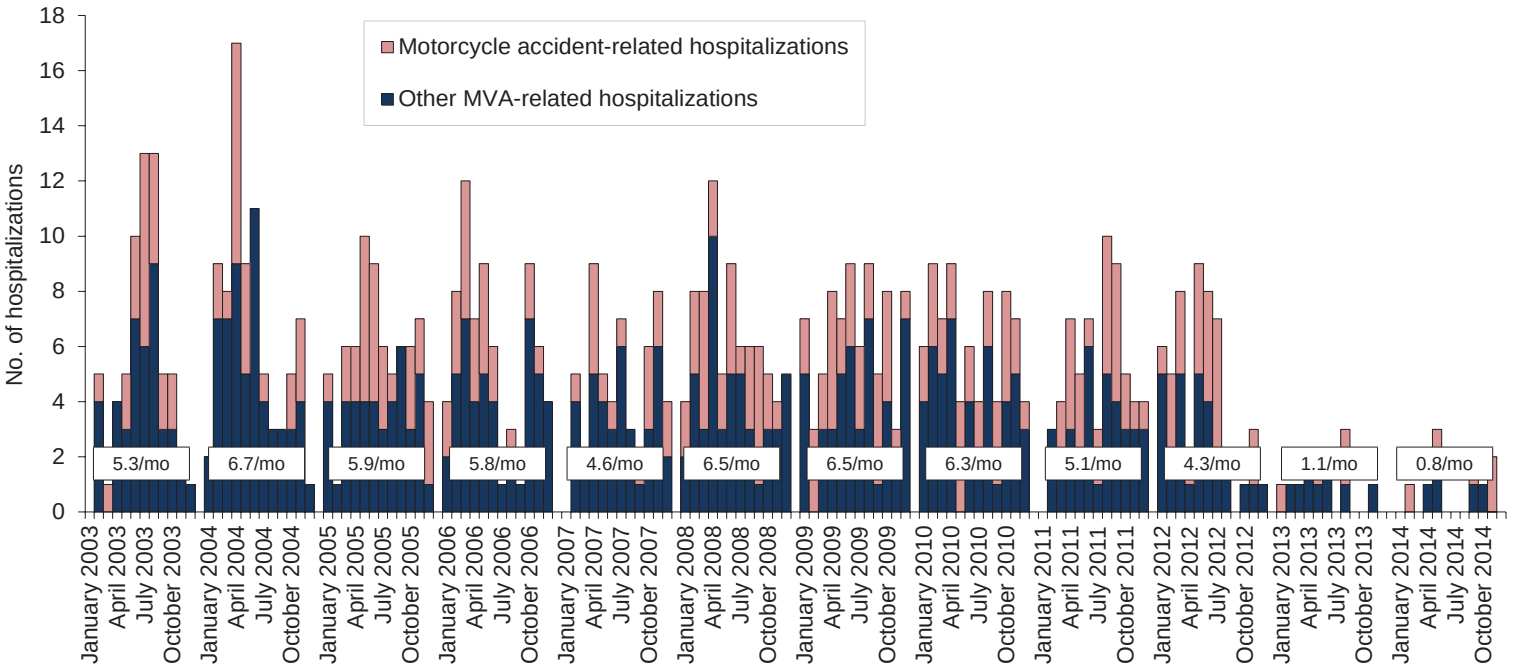
Leishmaniasis (ICD-9: 085.0–085.9)[b]



Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: leishmaniasis. Leishmaniasis among U.S. Armed Forces, January 2003–November 2004. *MSMR*. Nov/Dec 2004;10(6):2–4.
[b]Indicator diagnosis (one per individual) during a hospitalization, ambulatory visit, and/or from a notifiable medical event during/after service in OEF/OIF/OND.

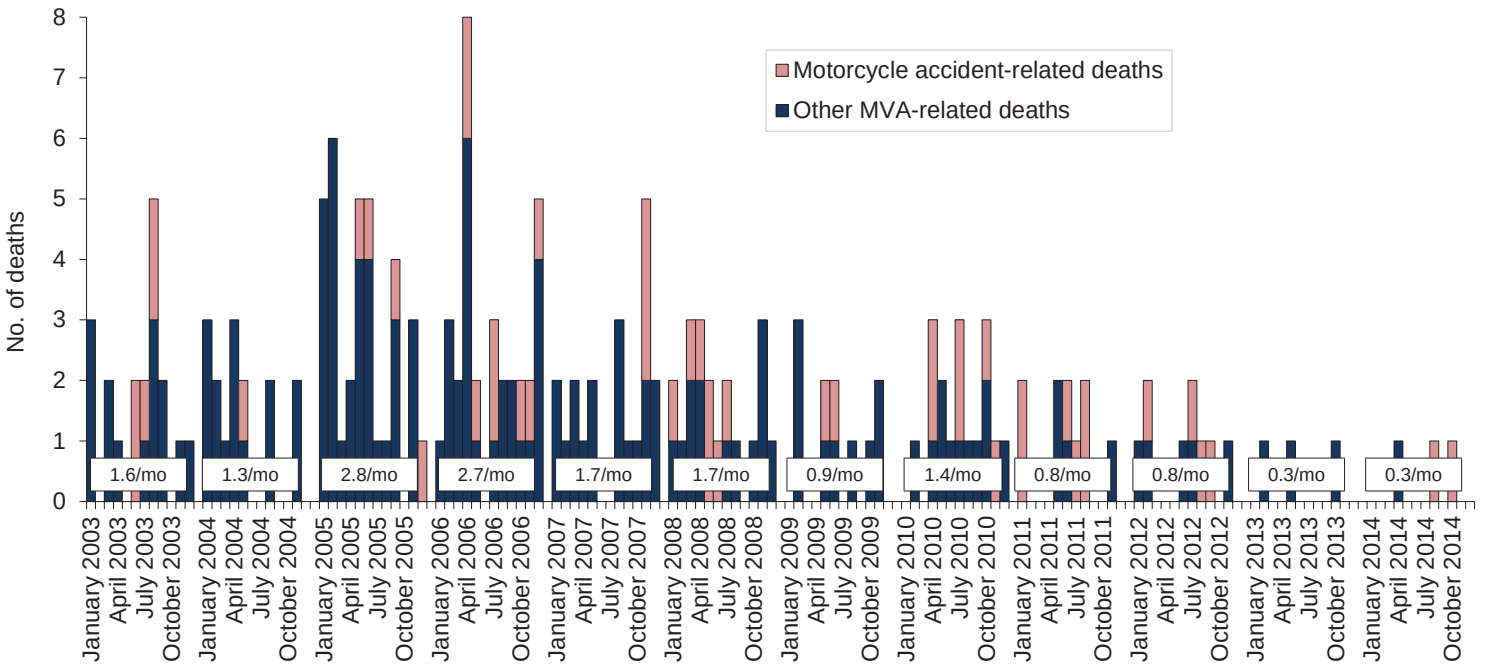
Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003–December 2014 (data as of 20 January 2015)

Hospitalizations outside of the operational theater for motor vehicle accidents occurring in non-military vehicles (ICD-9-CM: E810–E825; NATO Standard Agreement 2050 (STANAG): 100–106, 107–109, 120–126, 127–129)



Note: Hospitalization (one per individual) while deployed to/within 90 days of returning from OEF/OIF/OND. Excludes accidents involving military-owned/special use motor vehicles. Excludes individuals medically evacuated from CENTCOM and/or hospitalized in Landstuhl, Germany, within 10 days of another motor vehicle accident-related hospitalization.

Deaths following motor vehicle accidents occurring in non-military vehicles and outside of the operational theater (per the DoD Medical Mortality Registry)



Reference: Armed Forces Health Surveillance Center. Motor vehicle-related deaths, U.S. Armed Forces, 2010. *MSMR*. Mar 2011;17(3):2–6.
Note: Death while deployed to/within 90 days of returning from OEF/OIF/OND. Excludes accidents involving military-owned/special use motor vehicles. Excludes individuals medically evacuated from CENTCOM and/or hospitalized in Landstuhl, Germany, within 10 days prior to death.

Medical Surveillance Monthly Report (MSMR)
Armed Forces Health Surveillance Center
11800 Tech Road, Suite 220 (MCAF-CS)
Silver Spring, MD 20904

MEDICAL SURVEILLANCE MONTHLY REPORT (MSMR), in continuous publication since 1995, is produced by the Armed Forces Health Surveillance Center (AFHSC). The *MSMR* provides evidence-based estimates of the incidence, distribution, impact and trends of illness and injuries among United States military members and associated populations. Most reports in the *MSMR* are based on summaries of medical administrative data that are routinely provided to the AFHSC and integrated into the Defense Medical Surveillance System for health surveillance purposes.

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ISSN 2158-0111 (print)
ISSN 2152-8217 (online)